

## Claims

What is claimed is:

1. An integrated biomolecule sensor comprising a plurality of optical fibers whose proximal ends are held together with the end-faces arranged substantially in the same plane and oriented substantially in the same direction and which have probe polymers with different base sequences bound to the core end-face at their distal ends.
2. A method of fabricating the integrated biomolecule sensor of claim 1, comprising the following steps: forming an optical fiber bundle unit by holding the proximal ends of a plurality of optical fibers together with the end-faces arranged substantially in the same plane and oriented substantially in the same direction; and immersing the distal ends of the optical fibers of the optical fiber bundle unit separately in solutions containing probe polymers with different base sequences to let the probe polymer in each solution bind to the core end-face at the distal end of the optical fiber put therein.
3. A method of fabricating the integrated biomolecule sensor of claim 1, comprising the following steps: forming a number of partial optical fiber bundle units by holding the proximal ends of a plurality of optical fibers together with the end-faces arranged substantially in the same plane and oriented substantially in the same direction; immersing the distal ends of the optical fibers of each of the partial optical fiber bundle units separately in solutions containing probe polymers with different base sequences to let the probe polymer in each solution bind to the core end-face at the distal end of the optical fiber put therein; and joining the partial optical fiber bundle units into a complete optical fiber bundle unit.

4. The method of claim 2 or 3, wherein a linker is bound to the core end-face at the distal end of each optical fiber beforehand and the probe polymers are modified so as to be reactive to bind to the linker.
5. A kit used for fabricating the integrated biomolecule sensor according to the fabrication method of claim 2 or 3, comprising; a plate with wells for holding solutions containing probe polymers with different base sequences; and an auxiliary plate having holes so arranged in alignment with the wells of the plate as to make it easy to insert the distal ends of individual optical fibers of the optical fiber bundle unit or partial optical fiber bundle units separately into the corresponding different wells of the plate.
6. A method of fabricating the integrated biomolecule sensor of claim 1, comprising the following steps: forming an optical fiber bundle unit by holding the proximal ends of a plurality of optical fibers together with the end-faces arranged substantially in the same plane and oriented substantially in the same direction; holding the distal ends of the optical fibers of the optical fiber bundle unit in a synthesis vessel; and synthesizing a probe polymer with a desired base sequence on the core end-face at the distal end of each optical fiber by selectively introducing laser light into the optical fibers and supplying solutions of material bases with the photosensitive protecting group bound thereto beforehand into the synthesis vessel.
7. An apparatus for fabricating the integrated biomolecule sensor of claim 1, comprising: a synthesis vessel with a valved drain into which solutions of material bases used for synthesizing probe polymers are supplied; mount for supporting the optical fiber bundle unit with the distal ends of the optical fibers kept in the synthesis vessel; synthesis solution supply system for supplying solutions need for the synthesis of probe polymers including solutions of material bases with a photosensitive protecting group bound beforehand into the synthesis vessel; protecting group-dissociating

optical system for introducing laser light in the range of wavelengths that can photodissociate the photosensitive protection group from the probe polymers being synthesized into selected one of the optical fibers from the proximal end; moving mechanism for moving said mount for positioning in relation to said protecting group-dissociating optical system; and controller for controlling said synthesis vessel, synthesis solution supply system, protection group-dissociating optical system, and moving mechanism to synthesize a specified probe polymer on the core end-face at the distal end of each optical fiber.

8. A method of detecting biomolecules using the integrated biomolecule sensor of claim 1, comprising: immersing the distal end of said optical fiber bundle unit in a solution of a nucleic acid sample directly or indirectly labeled with a fluorophore; introducing laser light for exciting fluorescence into selected one of the optical fibers of the optical fiber bundle unit from the proximal; and measuring the intensity of the fluorescence light emitted by the fluorophore in the target polymer hybridized to the probe on the core end-face at the distal end of each optical fiber.
9. A biomolecule detection apparatus using the integrated biomolecule sensor of claim 1, comprising: a reaction vessel for holding the solution of a nucleic acid sample directly or indirectly labeled with a fluorophore; mount for supporting the optical fiber bundle unit with the distal ends of the optical fibers kept in the reaction vessel; fluorescence detection optical system for introducing laser light for exciting fluorescence into selected one of the optical fibers from the proximal end and measuring the intensity of the fluorescence light emitted by the fluorophore in the target polymer hybridized to the probe on the core end-face at the distal end of each optical fiber; moving mechanism for moving said mount for positioning in relation to the fluorescence detection optical system; and controller for controlling the fluorescence detection optical system and the moving mechanism to introduce laser light into selected one of

the optical fibers of the DNA sensor, read in the measured intensity of the fluorescence, display the data on a monitor and/or store the data on a storage.